

## **A combined effect of climate and fishery harvesting triggered a shift in a hake (*Merluccius merluccius*) population of the NW Mediterranean**

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The climate in North Atlantic (NA) has been demonstrated to influence climatic conditions in the Mediterranean Sea at a regional scale. The climatic shift in the early eighties in the NA triggered changes in local weather and hydrographical conditions at different areas of the NW Mediterranean. Ultimately, those changes influenced the dynamics of the primary and secondary production and gelatinous carnivorous dynamics. By the other hand, the long term fishery harvesting on a demersal species such as the European hake (*Merluccius merluccius*) underwent changes in the population properties and structure in the early eighties off the Balearic Islands (NW Mediterranean), which could trigger a change in the ecological response to the climatic variability. In the present study, we investigate the hypothesis that the ecological shift for hake off Balearic Islands (BA) resulted from a combined effect of fishery harvesting and environmental changes in the NA. We combine time series analyses (wavelet analyses) and population dynamics models to explore possible mechanisms. We hypothesize the combined effect of climate and fishery harvesting in the early eighties was as follow. Before 1980, NA climate influenced the population dynamics of hake which was healthy size structured with moderated fishery exploitation. Seven years cycles of NA climate provided favorable conditions to build up consistent cycles in the hake populations off the BA. After 1980, fishery exploitation eroded the size-structure of the hake population off BA, eliminating larger and older individuals which make the population strongly dependent of younger age classes (*juvnescent population*). At the same time, NA climate shift reduced the window of favorable conditions provided to *ca.* five year cycles, and triggered also changes in local weather and hydrographical conditions, which were affecting hake dynamics. It made that, under favorable conditions for hake off BA, the population has not enough time to build up an equivalent population to the period previous to 1980. As a consequence, the hake population stayed more dependent of inter-annual variation of recruitment after 1980, being closely related to inter-annual variability of local weather conditions.